Radial and angular rotons in trapped dipolar gases\textsuperscript{1} SHAI RO- 
NEN, JILA and Department of Physics, University of Colorado, Boulder, CO 80309- 
0440, USA, DANIELE BORTOLOTTI, JILA and Department of Physics, University 
of Colorado, Boulder, CO, USA; LENS and Dipartimento di Fisica, Universitá di 
Firenze, Italy , JOHN BOHN, JILA, NIST, and Department of Physics, University 
of Colorado, Boulder, CO 80309-0440, USA — We study Bose-Einstein condensates 
with purely dipolar interactions in oblate (pancake) traps. We find that the conden-
sate always becomes unstable to collapse when the number of particles is sufficiently 
large. We analyze the instability, and find that it is the trapped-gas analogue of 
the “roton- maxon” instability previously reported for a gas that is unconfined in 
two dimensions. In addition, we find that under certain circumstances, the con-
densate wave function attains a biconcave shape (like a red-blood cell), with its 
maximum density away from the center of the gas. These biconcave condensates 
become unstable due to azimuthal excitation - an angular roton.

\textsuperscript{1}USIEF (Fulbright program); DOE and the Keck Foundation.

Shai Ronen
JILA and the University of Colorado

Date submitted: 17 Nov 2006